RATIONALE

State of Tennessee General NPDES Permit for Discharges of Treated Groundwater Associated with Underground Storage Tank Remediation

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1. Introduction

The purpose of this rationale sheet is to provide the basis for State of Tennessee and National Pollutant Discharge Elimination System (NPDES) discharge permit conditions and related general permit procedures for any new or existing discharges of treated groundwater associated with petroleum product underground storage tank (UST) remediation, to surface waters of the State of Tennessee.

2. Background

Underground storage tanks (UST's) considered in this rationale sheet are those underground tanks which contain or have contained stored petroleum fuels, generally at gas stations and truck stops. The tanks are or were located underground for reasons of aesthetics, space savings, and safety. They range in size from 500 gallons to 40,000 gallons.

If the tank leaks, fuel seeps into the ground surrounding the tank, contaminating groundwater. Cleaning up the contaminated groundwater involves withdrawing the water, removing the contaminants and discharging the treated water into surface waters.

Water Resources laws require that discharges into the waters of the State of Tennessee or of the United States be permitted by the Department of Environment and Conservation and that the quality of the discharged water meets standards set by the department.

The discharges from these operations generally require the same effluent limitations and monitoring requirements. Since permit requirements for all these facilities are similar, it is the opinion of the Division of Water Resources (division) that this category of sources is controlled more appropriately under a NPDES general permit rather than under individual permits. General NPDES permits are issued by the Division of Water Resources in accordance with the division's Rule 0400-40-10-.01 through .03. This rationale sheet describes and gives the basis for permit conditions to be applied statewide to these discharges from the treatment of contaminated groundwater associated with underground storage tank remediation.

3. Description of Discharges

This permit will address only sites contaminated by petroleum fuels, primarily including leaded and unleaded gasolines, or diesel fuels.

The extent of the contamination to the groundwater from a leaking tank depends on several variables. The size of the leak in the tank, the number of tanks with leaks, the fuels which are being leaked, the material surrounding the tanks, (soil type, porous or non-porous rock), the proximity of the groundwater table, as well as other factors all contribute to the degree of the contamination. Discharges of treated contaminated groundwater generally will be typically between 1,500 to 20,000 gallons per day, based on the number of recovery wells and the treatment system at the site and the hours of operation.

4. Present Permit Conditions

The present NPDES General Permit TNG830000 contained effluent limitations and monitoring requirements for parameters that both the division and the Division of Underground Storage Tanks (DUST) considered significant characteristics of discharges from UST clean-up sites. It was decided at that time that the Division of Water Resources would establish effluent limits based upon available treatment technologies and water quality criteria.

The present General Permit was issued on August 1, 2018, and it expires on September 30, 2023. The present permit protects the quality of waters of the state by regulating the quality of water discharged from petroleum product underground storage tank remediation through the following numerical limitations and monitoring requirements:

Parameter	Effluent Limitation	Basis
Benzene	0.005 mg/L as a daily maximum concentration	Water Quality
Ethyl benzene	0.010 mg/L as a daily maximum concentration	Technology
Toluene	0.010 mg/L as a daily maximum concentration	Technology
Xylene	0.010 mg/L as a daily maximum concentration	Technology
Lead, total recoverable	0.45 mg/L as a daily maximum concentration	Technology
Lead, total recoverable	0.017 mg/L as a monthly average concentration *	Technology
Total Suspended Solids (TSS)	40.0 mg/L as a daily maximum concentration	Technology
Floating Material, Color, Foam and Oil Sheen	No distinctly visible floating scum, oil or other matter	Water Quality
pH	6.5 - 9.0 (range)	Water Quality
IC25 (see Note)	Survival, Reproduction, & Growth in 100 % effluent	Water Quality
48 Hour LC50 (see Note)	Survival in 100% effluent	Water Quality

* In addition to the daily maximum concentration limitation for total recoverable lead, monthly average limitation (based on Criterion Continuous Concentration CCC) will apply to those treatment systems that are discharging continuously for more than 4 days at any period of time.

In addition to those above, the following requirements were included in the previous permit:

- There shall be no distinctly visible floating scum, oil or other matter contained on or in the treated groundwater discharge.
- The treated groundwater discharge must result in no other materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.
- Sludge or any other material removed by any treatment works must be disposed of in a manner which prevents its entrance into or pollution of any surface or subsurface waters. Additionally, the disposal of such sludge or other material must be in compliance with the Tennessee Solid Waste Disposal Act, T.C.A. § 68-31-101 et seq. and the Tennessee Hazardous Waste Management Act, T.C.A. § 68-46-101 et seq.
- The treated groundwater discharge must not cause an objectionable color contrast in the receiving stream.

- The permittee shall use best management practices (BMPs) and good engineering practices to prevent contamination of the treated groundwater discharge from materials (including but not limited to excavation pumpout, excavated soil, equipment lubricants and products) associated with underground storage tank remediation activities.

5. Proposed Permit Conditions

5.1. State and EPA requirements

Under State and Federal law and regulations, a discharge permit must establish effluent limitations equivalent to best available technology economically achievable (BAT). For some industry categories, such effluent limitations have already been established by the EPA. This is not the case with UST groundwater remediation discharges; thus, the division has used Best Professional Judgment (BPJ) to choose effluent limitations that meet technology based levels equivalent to BAT.

Permits must also contain any requirements, in addition to or more stringent than technology-based limits, necessary to achieve water quality standards or to control all pollutants which may be discharged at a level which will cause, have the reasonable potential to cause or contribute to an excursion above any state water quality standard, including narrative criteria.

5.2. Pollutants to be limited and standard technology

The division proposes limiting the following parameters: total suspended solids (TSS), pH, total recoverable lead, benzene, ethyl benzene, toluene, xylene, whole effluent toxicity, and floating material, color, foam and oil sheen.

The division believes that air stripping, or equivalent treatment, followed by activated carbon absorption, if necessary, is equivalent to BAT and is used as the basis for the proposed limits.

Benzene, ethylbenzene, toluene, and xylene are typical organic pollutants of petroleum fuel contamination in groundwater, and are among the least volatile components of gasolines. The division proposes that these contaminants be limited and monitored as indicators of the effectiveness of the treatment systems used.

The division's BPJ-BAT level for each of these parameters is 0.010 mg/L as a daily maximum concentration. To insure that the proposed limit protects water quality, this BAT-based level was compared to water quality criteria.

Benzene – For benzene, E.P.A.'s 1986 Quality Criteria for Water states acute toxicity to fresh water aquatic life occurs at concentrations as low as 5.3 mg/L. The State of Tennessee

Water Quality Standards do not include a fish and aquatic life criteria for benzene. For the recreation classified use, Tennessee's standards specify 0.022 mg/L for water and organisms criteria and 0.510 mg/L for the organisms only. The water and organisms criteria are for protection of public health due to consumption of water and organisms and should only be applied to waters designated for both recreation and domestic water supply. The criteria for water classified for domestic water supply is 0.005 mg/L. Because some sites likely to be covered under this general permit will discharge to the water supply classification, the division proposes that 0.005 mg/L be set as the daily maximum limit for benzene.

Ethyl benzene – For ethyl benzene, the division has promulgated concentration levels in the recreation and domestic water supply classification. For the recreation classified use, Tennessee's standards specify 0.53 mg/L for water and organisms criteria and 2.1 mg/L for the organisms only. The water and organisms criteria are for protection of public health due to consumption of water and organisms and should only be applied to waters designated for both recreation and domestic water supply. The domestic water supply criterion for ethyl benzene is 0.700 mg/ L.

The water quality criteria is less stringent than the technologically achievable levels, so the previous permit limit for ethyl benzene will be retained at 0.010 mg/L, as a daily maximum concentration.

Toluene – For toluene, the division has promulgated concentration levels in the recreation and domestic water supply classifications. For the recreation classified use, Tennessee's standards specify 1.3 mg/L for water and organisms criteria and 15 mg/L for the organisms only. The water and organisms criteria are for protection of public health due to consumption of water and organisms and should only be applied to waters designated for both recreation and domestic water supply. The domestic water supply criterion for toluene is 1.000 mg/ L.

The water quality criteria is less stringent than the technologically achievable levels, so the previous permit limit for toluene will be retained at 0.010 mg/L, as a daily maximum concentration.

Xylene – For xylene, the division has promulgated concentration levels for the domestic water supply classification. The criterion for total xylenes is 10.000 mg/L. The water quality criteria is less stringent than the technologically achievable levels, so the previous permit limit for xylene will be retained at 0.010 mg/L, as a daily maximum concentration.

Lead, total recoverable – Process wastewater discharges of treated groundwater associated with underground storage tank remediation can be intermittent or continuous. The table below shows the division's standardized calculations for establishing allowable effluent concentrations protective of receiving stream designated uses (acute and chronic criteria). For acute and chronic criteria, EPA recommends averaging periods of 1 hour and 4 days,

respectively. Please note that stream background concentration, listed at 50% of allowable chronic number, does not affect the result, since the receiving stream flow is 0 MGD.

Stream (1Q10) [MGD]	Stream (30Q5) [MGD]	Waste Flow [MGD]	Ttl. Susp. Solids [mg/l]	Hardness (as CaCO3) [mg/l]	Stream Allocation [%]
0.000	0.000	0.020	10	100	100

	1	2	3	4	5	6	7	8
	Stream Bckgrnd.	Fish/Aqua. Life Water Quality Criteria		Effluent Fraction	Fish & Aquatic Life Water Quality Criteria (1Q10)			
					In-Stream Allowable		Calc. Effluent Concentration	
EFFLUENT CHARACTERISTIC	Conc.	Chronic	Acute	Dissolved	Chronic	Acute	Chronic	Acute
	[ug/l]	[ug/l]	[ug/l]	[Fraction]	[ug/l]	[ug/l]	[ug/l]	[ug/l]
Lead *	4.093	2.517	64.581	0.143	17.539	450.093	**17.5**	**450.1**

	9	10	11	12	13	14
	Human Health Water Quality Criteria (30Q2)					
	In-Stream Criteria			Calc. Effluent Concentration		
EFFLUENT CHARACTERISTIC	Organisms	Vater/Organisms	DWS	Organisms	Vater/Organisms	DWS
	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]
Lead *	NA	NA	5.0	**NA**	**NA**	**5.0**

* Denotes metals for which Fish & Aquatic Life Criteria are expressed as a function of total hardness.The Fish & Aquatic Life criteria for this metal are in the dissolved form at laboratory conditions. The in-stream allowable criteria and calculated effluent concentrations are in the total recoverable form.

NOTE: Water Quality criteria for stream use classifications other than Fish & Aquatic Life are based on the 30Q5 flow. However, the calculated effluent concentration was based on the zero low-flow conditions, which is not in accord with an underlying concept of a receiving stream being used as a source for domestic water supply on a continuous basis.

Based on the above calculated effluent concentration, the limitation for lead will be adjusted to 0.018 mg/L (rounding to the nearest hundredth). If a continuous flow of treated groundwater is discharged into a zero low-flow receiving stream, such effluent has to be protective of in-stream criteria for total recoverable lead. Therefore, assuming the most conservative discharge scenario (zero low-flow receiving stream, continuous discharge), the total recoverable lead limitation would be 0.008 mg/L, to apply only to treatment systems discharging continuously for more than four days at any period of time into a zero low-flow receiving stream. The applicable critical low-flow values are determined using either the USGS The StreamStats Program webpage (StreamStats) or USGS data from: "Flow Duration and Low Flows of Tennessee Streams through 1992 by George S. Outlaw and Jess D. Weaver; Water Resources Investigations report 95-4293 prepared by the U.S. Geological Survey in Cooperation with the Tennessee Department of Environment and Conservation and the Tennessee Valley Authority, Nashville, Tennessee, 1996" (or the most current edition, or other appropriate USGS sources) or the USGS Tennessee Stream Stats web page (TN StreamStats).

The total recoverable lead limits shall be 0.45 mg/L daily maximum concentration and 0.017 mg/L monthly average concentration.

The division will notify the applicant of applicability of test requirements and applicable limits in writing; the notification will be included with the Notice of Coverage (NOC).

Total Suspended Solids (TSS) – The division proposes to retain the BPJ limit of 40 mg/L as a daily maximum concentration. The division believes this limit will provide protection of Tennessee narrative water quality criteria, which states, in part: "there shall be no distinctly visible floating scum, oil or other matter contained on or in the waste water discharge."

Floating Material, Color, Foam and Oil Sheen – Visual monitoring for the presence of scum, oil or other matter on or in the discharge will be required based on the department's current Water Quality Criteria for Solids, Floating Materials and Deposits (Rule 0400-40-3-.03 (1) (e)).

The monitoring requirement for Floating Material, Color, Foam and Oil Sheen replaces a previous monitoring requirement for Oil and Grease. The following narrative criteria for Floating Material, Color, Foam and Oil Sheen replaces an earlier numeric limitation for Oil and Grease of 15 mg/L: "No distinctly visible floating scum, oil or other matter." In addition, consultation with the Division of Underground Storage Tanks and considering that the standard method for the treatment of the contaminated groundwater is air stripping, followed by activated carbon absorption, it is the division's judgment that a visual monitoring of the effluent will be sufficient to protect the narrative water quality criteria.

pH – According to the department's current Water Quality Criteria for pH (Rule 0400-40-3-.03 (3)(b)), the pH for the protection of Fish and Aquatic Life shall lie within the range of 6.5 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours. Considering that some, if not many receiving streams are zero-flow streams under low flow conditions, and will therefore provide little or no buffering capacity for treated contaminated groundwater, the division proposes a water-quality based pH limit range between 6.5-9.0.

Whole Effluent Toxicity (WET) – Since the treated discharge may contain some level of toxic substances, i.e. benzene, ethyl benzene, toluene, etc., the division feels toxicity testing is necessary to insure the discharges will not adversely affect the quality of the receiving waters. Based on current individual NPDES permit requirements, and that proper performance of treatment equipment can reduce or eliminate effluent toxicity, the permit will require that 100% effluent have no toxicity. The WET tests to be used are IC25 (Survival, Reproduction, & Growth in 100 % effluent) and 48 Hour LC50 (Survival in 100 % effluent). The species shall be the water flea (Ceriodaphnia dubia) and the fathead minnow (Pimephales promelas). Toxicity will be demonstrated if the 48 Hour LC50 or IC25 is less than or equal to the permit limit (100 % effluent).

The type of WET testing applicable to any discharge depends on the receiving stream low flow conditions. The applicable critical low flow values are determined using either the USGS The StreamStats Program webpage (StreamStats) or USGS data from: "Flow Duration and Low Flows of Tennessee Streams through 1992 by George S. Outlaw and Jess D. Weaver; Water Resources Investigations Report 95-4293 prepared by the U.S. Geological Survey in Cooperation with the Tennessee Department of Environment and Conservation

and the Tennessee Valley Authority, Nashville, Tennessee, 1996" (or the most current edition, or other appropriate USGS sources). The applicable critical low flow values for Fish and Aquatic Life Protection are: 7Q10 for low flow under natural conditions and 1Q10 for regulated low flow conditions. Discharges into zero low flow receiving streams and streams that provide dilution factor of 100:1 or less will have to comply with the numerical effluent limitation for IC25. Discharges with dilution factor of receiving stream to effluent between 100:1 and 500:1 will have to comply with the numerical effluent limitation for 48 hour LC50. If the calculated dilution factor is more than 500:1, and assuming immediate and complete mixing, the permittee can request a waiver of the whole effluent toxicity testing requirement. The waiver of the whole effluent toxicity testing shall be made in writing to the division's local Environmental Field Office. This information is summarized in the table below:

Dilution Factor	**0-100**	**100-500**	**>500**
Type of WET testing	IC25	LC50	No Testing Required
Percent Effluent	100%	100%	Not Applicable

Calculation of dilution factor is as follows:

$$DF = \frac{Qs + Qw}{Qw} = \text{Dilution Factor}$$

where Qw is a long-term average treated groundwater flow rate and Qs is a receiving stream low flow (7Q10 or 1Q10, see text above).

The division will notify the applicant of applicability of this test requirement in writing; the notification will be included with the Notice of Coverage (NOC).

5.3. Proposed water quality based conditions

The following standard permit language is included in the permit:

- The treated groundwater discharge must result in no other materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.
- Sludge or any other material removed by any treatment works must be disposed of in a manner which prevents its entrance into or pollution of any surface or subsurface waters. Additionally, the disposal of such sludge or other material must be in compliance with the Tennessee Solid Waste Disposal Act, TCA § 68-31-101 et seq., and the Tennessee Hazardous Waste Management Act, TCA §68-46-101 et seq.
- The treated groundwater discharge must not cause an objectionable color contrast in the receiving stream.

- The permittee shall use best management practices (BMPs) and good engineering practices to prevent contamination of the treated groundwater discharge from materials (including but not limited to excavation pumpout, excavated soil, equipment lubricants and products) associated with underground storage tank remediation activities.

5.4. Monitoring and reporting requirements

Monitoring requirements will be set at once per quarter, except for the toxicity testing (see part 5 of the permit). If the calculated dilution factor is more than 500:1, and assuming immediate and complete mixing, there will be no WET testing required, unless toxicity was shown in the previous WET tests. Toxicity testing information is summarized in the table below If the calculated dilution factor is more than 500:1, and assuming immediate and complete mixing, the permittee can request a waiver of the whole effluent toxicity testing requirement. This information is summarized in the table below:

Dilution Factor	**0-100**	**100-500**	**>500**
Type of WET testing	IC25	LC50	No Testing Required
Percent Effluent	100%	100%	Not Applicable

For the first three months of the initial start-up operations, whole effluent toxicity (WET) testing shall be conducted monthly on two appropriate test species. For established and renewed permitted operations, WET testing shall be conducted once during the first 180 days from the effective date of coverage under the general permit. If toxicity is determined in any of these tests, annual testing will be required for the duration of the permit.

At the end of the initial WET testing period it is the responsibility of the permittee to notify the division of their results and to request either removal of the WET testing requirement or an annual testing frequency, based on their results. Requests should include the permit tracking number assigned, as shown on the Notice of Coverage, and should be submitted to the division at the address shown in part 5 of the permit.

6. General Permit Issuance Procedures

This general permit is drafted in accordance with applicable NPDES regulations (40 CDR 122, 123, 124 and 125), the Tennessee Water Quality Control Act (§ 69-3-101 et seq.), and the department's permit issuance regulations (Rules of the department 0400-40-1-.05 and 0400-40-10.01 through .03).

7. Permit Issuance and Public Notice Procedures

This general permit is drafted in accordance with applicable NPDES regulations (40 CFR 122, 123, 124, and 125), the Tennessee Water Quality Control Act (T.C.A. § 69-3-101, et.seq.), and the TDEC's permit issuance regulations in TN Rule 0400-40-05. The applicable

regulations for issuance of this general permit are found in 40 CFR 122.28 and 123.44, and the regulations for fact sheet (Rationale) requirements are found in 40 CFR 124.8 and 124.56.

The division will publish notice of its intent to issue the General NPDES Permit for Discharges of Treated Groundwater Associated with Underground Storage Tank Remediation and had published the notice of the public hearing (NOPH-004) to receive comments on the draft permit. Thirty days' notice was given for the public hearing. Specifically, the details regarding the public hearing are as following:

Date:	**September 18, 2023**
Time:	**12:30-1:00 PM CDT, Informal Questions and Answers** **1:00-2:00 PM CDT, Formal Public Hearing**
Meeting Location:	
TDEC William R. Snodgrass - Tennessee Tower 312 Rosa L. Parks Ave. 3rd floor Multi-Media Room Nashville, TN 37243	
Ways to Participate:	
In person (see above for the meeting location) Log in online (see login info below) Call in by phone (see call-in info below)	
Virtual Login Info: **To access the meeting or join anytime during the Q&A session or the formal public hearing, click on the link or copy the URL to your web browser.**	
Microsoft Teams meeting **Join on your computer, mobile app or room device** https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZWZmYTdhMTEtMjkxOC00NDZhLWExOGEtOWJkMTAzYmFkNTQ5%40thread.v2/0?context=%7b%22Tid%22%3a%22f345bebf-0d71-4337-9281-24b941616c36%22%2c%22Oid%22%3a%22e809db82-3ab4-4d68-8f76-f6729b3e3123%22%7d Meeting ID: 221 202 158 976 Passcode: kdgeFB Download Teams | Join on the web **Join with a video conferencing device** stateoftn@m.webex.com Video Conference ID: 111 367 278 0	
Call-in Information	
+1 629-209-4396,,694406143# United States, Nashville Phone Conference ID: 694 406 143#	

Comments will be received for 10 ten days after the hearing. Any interested person may request copies of the rationale (fact sheet) and draft permit and submit written comments on the draft permit.

For additional information, or to submit comments, contact:

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